UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

December 2, 2013

Catherine Jerrard
Program Manager/BEC
AFCEC/CZRB-Griffiss
706 Brooks Road
Rome, New York 13441

Re: Draft Remedial Design and Remedial Action Work Plan for Operable Unit 2, Revised Groundwater Remedy, Former Williams Air Force Base, Mesa, AZ, June 21, 2013

Dear Ms. Jerrard:

EPA has reviewed the Draft Remedial Design and Remedial Action Work Plan (RD/RAWP) for Operable Unit 2, Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona, dated October 4, 2013 prepared by your consultant, Amec and their subcontractor, TerraTherm. In general, the RD/RAWP lays out a comprehensive design for the revised groundwater remedy for Site ST012 which is consistent with the Record of Decision Amendment 2 (RODA2) signed by EPA on September 28, 2013. During the October 8, 2013 teleconference EPA requested the criteria for shutdown of the Steam Enhanced Extraction (SEE) be formally specified somewhere in the document. The shutdown criteria was subsequently provided for discussion during the November 19, 2013 Base Closure Team (BCT) meeting. Our comments on both the RD/RAWP and shutdown criteria are provided below.

General Comments

1. Please note the new Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions OSWER 9355.0-129 signed November 25, 2013 (enclosed) now specifies that post remediation monitoring data demonstrate attainment of Remedial Action Objectives on a well by well basis.

2. EPA acknowledges that the SEE thermal treatment zone (TTZ) has already been expanded based on contamination found in borings installed during the pre-design investigation (as discussed in Section 3.2.2 of the RD/RAWP). However, a substantial amount of LNAPL will still remain unaddressed outside of the TTZ. According to Table 3-2 of the RD/RAWP, it is estimated that as much as 500,000 gallons of LNAPL remain

outside of the TTZ. EPA recognizes that there are constraints on expanding the SEE TTZ in some areas, such as Sossaman Road to the east and the Army Reserve Center to the west. However, we remain concerned that the extremely large amount of LNAPL estimated to be outside of the TTZ will be a significant hindrance to obtaining the RODA2 remedial goals within the desired time frame of 20 years. Consideration should be given to fully defining the extent of Light Non-Aqueous Phase Liquids (LNAPL) at the site, and possible ways to expand the SEE TTZ and/or the Enhanced Bioremediation (EBR) treatment zone.

3. The criteria to be used to determine when to terminate steam injection and initiate EBR should be prescribed in the RD/RAWP. The criteria were discussed during the November 19, 2013 BCT meeting, and the points that were brought up during the discussion, which included that fact that multiple lines of evidence, not just one criteria, will be considered when deciding when to terminate steam injection, need to be incorporated into the RD/RAWP. It should be made clear that first the temperature criteria must be met in the TTZ (excluding the low permeability zone (LPZ), which is not likely to take steam), and verified by the energy balance, and the pressure cycling completed (showing no additional significant increases in effluent vapor phase concentrations when steam injection is reduced) before consideration is given to whether recovery has decreased sufficiently from the peak recovery rate to justify termination of steam injection. We discussed during the BCT meeting that the expectation is that the benzene target criteria of 100 to 500 µg/L is high (i.e., lower concentrations are expected to be achieved) in the interior portion of the TTZ, but that this target was chosen because the modeling predicted that benzene concentrations greater than 500 µg/L would not degrade within the time frame for achieving remedial goals. It must also be recognized that even when the recovery rate falls below 10 percent of the peak recovery rate, significant contaminant mass may still be recovered, and consideration should be given to whether it is more effective to continue recovering that mass via SEE or to try to degrade it with EBR.

4. The data requirements established by these criteria for terminating SEE operations should be included in the sampling and analysis plan. Monitoring during the pressure cycling phase and while evaluating the potential end of steam injection must be sufficient to demonstrate that pressure cycling has accomplished what it can. Also, it should demonstrate that mass still being recovered is mostly from outside of the TTZ.

Specific Comments

1. It would be helpful to have a figure (or figures) for each of the remedial zones that delineate the TTZ, the EBR area, and the soil and/or groundwater data from each boring or well around the perimeter of the TTZ and EBR area to give a visual presentation of the characterization data collected during the pre-design investigation, as well as historical data, that is being used to determine the TTZ and the treatment area for EBR.

2. Page 3-9, lines 768 to 770, states that in perimeter wells that exhibit signs of LNAPL, cyclic steam injection will be used to avoid spreading contamination. However, extracting all recoverable LNAPL before injecting any steam, as outlined on page 17 of TerraTherm's Design Report (Appendix D), is a more assured way of avoiding spreading contamination. Please revise this section to state that significant recoverable LNAPL will be recovered before cyclic steam injection is initiated. This will make this section consistent with lines 1251 – 1252 on page 4-5, which state that where LNAPL exists on the perimeter of the treatment zone, initial extraction is anticipated.

3. Page 4-5, lines 1249 – 1250, states that injection strategies will be refined during the RD/RA phase to address potential LNAPL migration. This was discussed during the November 19, 2013 BCT meeting and it was agreed that an update to the RD/RAWP would be provided once the characterization/well installation is complete.

4. Page 4-7, first bullet, states that steam will be injected with the intent of creating a steam zone from the injection wells to the extraction wells. Breakthrough of steam at the extraction wells is critical for recovery of contaminants both as an LNAPL and in the vapor phase, thus, every effort should be made to ensure that steam breakthrough occurs in all areas of the TTZ (with the exception of the LPZ which may not accept enough steam for this to occur).

5. Section 5.6.3: It would be helpful to include a table that details all of the performance and operational monitoring to be done. The table should include baseline sampling to be done before SEE startup, the monitoring program to support the determination that steam injection should be terminated (see comment #2), monitoring to demonstrate that hydraulic and pneumatic control are being maintained, monitoring to demonstrate that LNAPL and dissolved contaminants are not being spread, sampling to document the amount of mass recovered, and monitoring to demonstrate that the discharge criteria are met. This would include all of the analytical samples to be obtained of extracted and treated vapors and groundwater, as well as screening samples of vapors and liquids from the manifolds and/or individual wellheads, and sampling to determine which wells are producing LNAPL. Where flow rates must also be determined in order to calculate the amount of mass being recovered, these measurements should also be included in the table. The minimum frequency of each of these monitoring activities should also be clearly defined in the table.

6. Page 5-6, in the last paragraph, lists the wells to be gauged for groundwater elevation and LNAPL on a weekly basis. Please consider adding the following wells to this list: ST012-U13, ST012-U36, ST012-C02, ST012-RB-2A, and ST012-W12. Wells that are on the list but are more than 200 feet from the TTZ (i.e., ST012-C01), may potentially be dropped from the list of wells to be monitored. It is clear that some areas surrounding the lower saturated zone (LSZ) will not be monitored by these existing wells, for example, to the west of the TTZ.

7. Section 5.7 on Page 5-2 (note that this is the second time this page number was used)

states that analytical data will be posted on the AMEC website only after the data has been validated, and will be reported only quarterly with the SVE reports. During SEE operations, conditions change quickly, and decisions about the operation of the system must be made quickly, based on all the data being collected. It is important to post and make use of analytical data as soon as possible, even if it is not yet validated. This data should be included in weekly progress reports, with the data presented by TerraTherm. This will be especially important during the latter stages of the SEE process when termination of steam injection is being discussed.

8. Appendix D, page 14, third paragraph, discusses site heterogeneity and steam flow properties that could lead to uneven distributions of heat in the subsurface, and concludes, "The completeness of heating, and the associated achievement of the conditions necessary for effective reduction of LNAPL concentrations will have some uncertainty associated with it". That having been said, and knowing that this site is very heterogeneous and the well spacing to be used is large (minimum of 70 feet), consideration should be given to increasing the number of thermocouple strings in the TTZ to increase the probability of finding which areas are not heating as rapidly as the rest of the site, so that operational changes can be made in a timely manner to improve the uniformity of heating.

9. Appendix D, page 24, in the last paragraph, states "the CZ (Cobble Zone) was conservatively assumed to be fully saturated at start-up, which is why the air volume in the HZ is shown to be zero in Table 5.5". However, Table 5.5 shows the air volume in the heated zone (HZ) to be 3,625 CY. Please clarify.

10. Appendix D, Section 5.9.6: Please describe in more detail what a 'thermal accelerator' is and how it differs from a thermal oxidizer.

11. Appendix D, Section 5.14.2: What equipment will be powered by the standby generator? In other words, what equipment will be maintained operational during a power outage?

12. Appendix D, Section 5.15: Please define what is meant by "Area Classification", the information contained in Table 5.16, and the conclusions that were drawn based on this analysis in terms that those unfamiliar with the codes can understand.

13. Appendix E, Section 2, states, "the groundwater flow model created for this project is roughly based on the model created for the Thermal Enhanced Extraction (TEE) Pilot Test Report'. However, Section 2 goes on to state, "These hydraulic conductivity fields were copied from Figures M.3.2.1 and M.3.2.2 in Appendix M of the TEE Pilot Test Report (BEM, 2010)", and Section 3 states, "If the computed gradient and flow direction for the steady-state model closely matched the gradients and flow direction reported in Appendix M of the TEE Pilot Test Report . . . ". These last two statements indicate a heavy reliance on the TEE model to develop and calibrate the present model. Comments made by EPA on the TEE model pointed out that the model was not able to predict groundwater levels within the TEE pilot study area with sufficient accuracy to verify that

hydraulic containment was achieved during the pilot study, which brings into question the accuracy of the model. It is not clear from this modeling report that the model was sufficiently improved to provide reliable results for the present modeling efforts.

14. Appendix E, Section 5, describes groundwater flow modeling to demonstrate containment during SEE. However, the model fails to consider the formation of a steam zone in the subsurface as steam as injected, and the fact that steam will displace considerably more (approximately 1500 times more) groundwater than would be displaced by the same weight of water. Thus, it is not clear that the modeling, as it was performed, is meaningful to demonstrate containment during SEE operations. Monitoring of surrounding wells during operations will be a better (although not perfect) indication of whether or not containment is being maintained. The monitoring should be expanded to ensure that all areas where there is the potential for LNAPL to be pushed away from the TTZ are monitored (see comment #8).

15. Figures E-4.2, E-4.3 and E-4.4: Based on the data collected during the pre-design investigation and during the current effort to install wells for the SEE system (data presented during the November 19, 2013 BCT meeting), it does not appear that the full extent of possible LNAPL is covered by the recirculation system for the EBR. There is the potential for significant contamination to be present to the south in the LSZ in the tank farm area based on the results at ST012-LSZ11 and ST012-LSZ39, and to the north, based on the results at ST012-LSZ7. The results for ST012-LSZ39 presented during the BCT also indicated the potential for LNAPL in the upper water bearing zone (UWBZ) in this area. Figure E-4.2 shows that the recirculation system does not cover the full extent of expected LNAPL in the cobble zone (CZ).

16. Appendix E, Section 4.1, states, "The remediation well screen sections in the UWBZ were refined based on particle tracking analysis conducted using the groundwater flow model. Initially the remediation well screens were positioned across the entire thickness of the UWBZ . . . however, due to the high conductivity of the overlying CZ a large portion of injected liquids traveled rapidly upwards exiting into the CZ." This seems contradictory to the findings during the TEE pilot test, as interpreted by TerraTherm, "The low-permeability zone below the CZ seemed to contain the steam from the UWBZ, as evidenced by the slow heating of this layer, and minimal heating of the CZ." (Appendix D, page 15)

17. Appendix E, Table E-4.8 is entitled, Estimated LNAPL Volume in EBR Treatment Zones Following SEE Treatment, however, the footnotes indicate that the data in the table is based on the pre-design investigation report. Please clarify whether these volumes and saturations are pre- or post SEE treatment.

18. Appendix H, Worksheet 11, Step 2, lists one decision statement of the Work Plan as, "Do dissolved phase benzene and TPH concentration data indicate reduction of possible LNAPL at the well locations within the treatment area during SEE system operation?" It is not clear that the sampling required to answer this question is included in the Sampling

and Analysis Plan presented in Section 5.6.3 of the RD/RAWP, which only states that liquid samples "may be collected from individual MPE wells . . ." and does not state what analysis will be performed on the samples.

19. Appendix H, Worksheet No. 12: Another objective of the sampling, which does not appear to be included in the problem definition and decisions, should be to collect data to aid in determining when to terminate steam injection and transition to EBR.

20. Appendix H, Worksheet No. 12, Step 3, states, "VOC and TPH results for air will be the primary input for decisions relative to system performance". However, LNAPL recovery and dissolved phase concentrations also will significantly affect decisions relative to system performance.

21. Appendix H, Worksheet No. 12, Step 4: Should the CZ be included in the Study Boundaries?

22. Appendix H, Worksheet No. 12, Table 12.1: In the second column, should the EPA Method be 8260 rather than 8060?

23. Appendix H, Worksheet No. 15: Although naphthalene does not currently exceed cleanup criteria over large areas, it is possible that naphthalene concentrations in groundwater could increase following SEE treatment in areas that are not fully treated, due to the fact that its effective solubility will increase after lower boiling compounds (such as benzene, toluene, ethyl benzene, and xylene) are substantially removed.

24. Appendix H, Worksheet No. 18: Will groundwater samples from within the SEE TTZ be analyzed during and after SEE operations? This does not appear to be included in the tables, however, benzene concentrations are proposed as one line of evidence on which to decide when steam injection should be terminated; thus, groundwater samples must be obtained during SEE treatment to have this information available for decision making. Groundwater samples are generally also taken post-SEE operations in order to determine remaining contamination levels.

25. Appendix H, Worksheet No. 33, Section 33.1: How will SEE operational data be made available to the regulatory agencies? Due to the fact that operations proceed very quickly during thermal remediation, it is recommended that reporting be done at least monthly rather than quarterly during operations. More frequent communications are likely to be recommended as the system approaches diminishing returns, and discussions are underway on when to terminate steam injection.

If you have any questions regarding these comments, please contact me at (415) 972-3150.

Sincerely,

Carolyn d'Almeida

Carolyn d'Almeida
Remedial Project Manager

enclosure

cc: Wayne Miller, ADEQ